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GB 1573494

GB 1545097

(58) Field of search  
A6D

## (54) Tennis racket

(57) A tennis racket frame 1 of hollow section is formed by two hollow profiles 3, 4 which abut in a plane which registers with the plane of the strings of the racket or is parallel thereto. The two profiles 3, 4 may be identical mouldings, or they can be produced so that the profile 3 includes string guides 8 enabling the racket to be strung whilst the two profiles 3, 4 are separated, and the profile 4 includes retainers which, when the profiles are assembled together, ensure that the strings are retained in the guides 8.

Connection of the two profiles may be by interengagement of pins and pin guides on the two parts, bolts and/or adhesive.

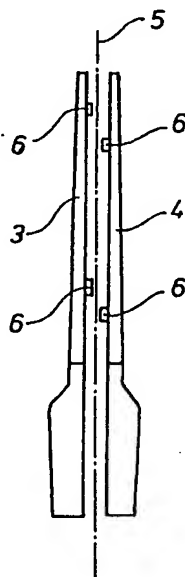


FIG 2

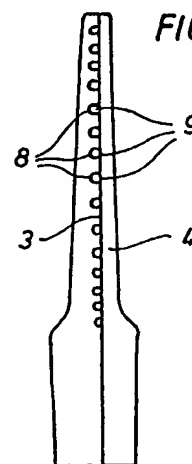


FIG 3

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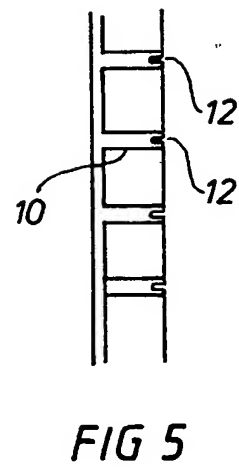
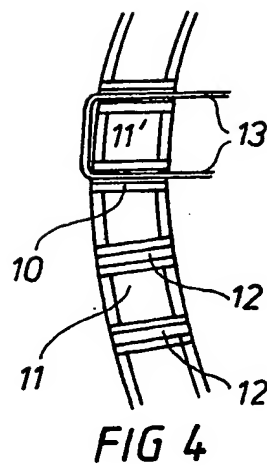
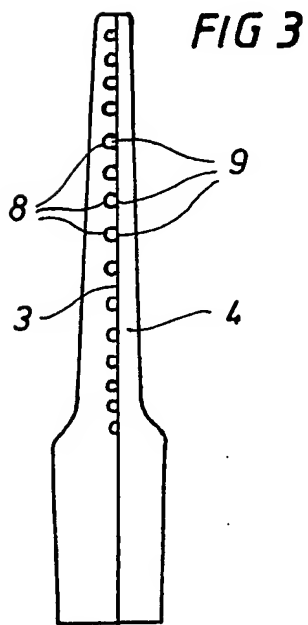
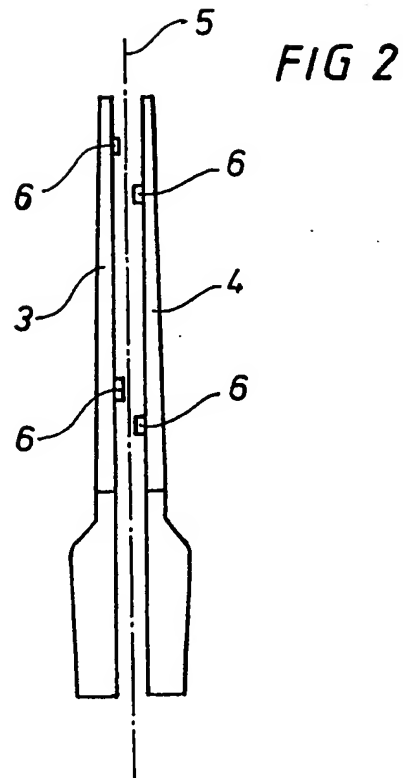
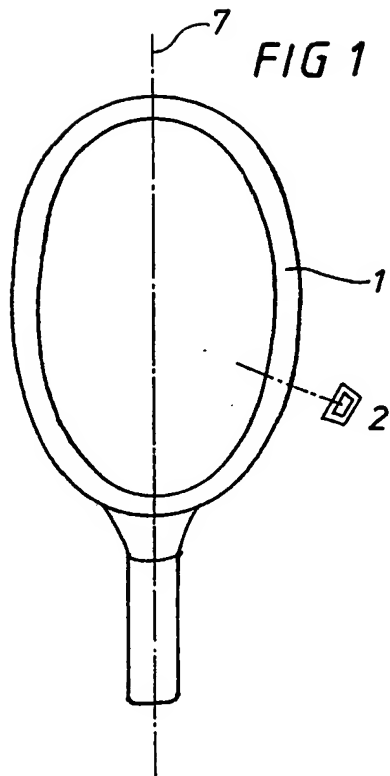


FIG 6

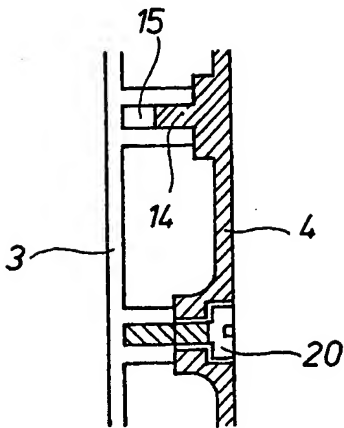


FIG 7

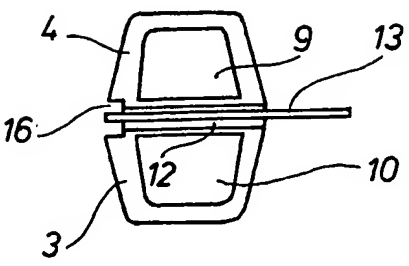


FIG 8

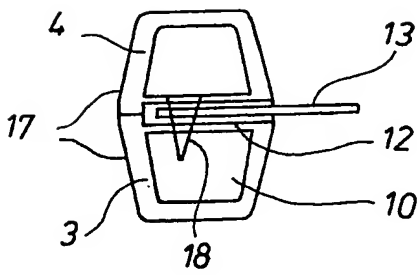


FIG 9

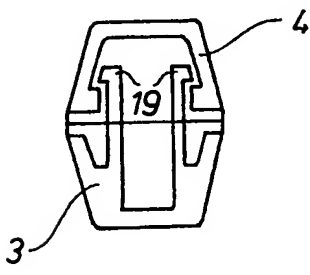
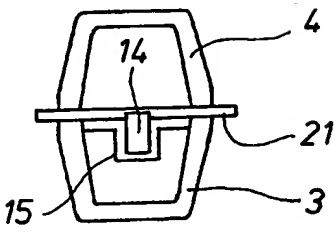


FIG 10



## SPECIFICATION

### A tennis racket

5 The technical demands on tennis rackets lead to ever increasingly expensive and complicated methods of production. At the same time, progressively increasing labour costs require constant improvements in production in order to compensate, at least partially, 10 for the increasing technical requirements.

The invention relates to a special tennis racket construction which can be produced either in plastics material or in light metal. Building on the good experiences which have been obtained in recent 15 years with tennis rackets made of hollow profiles or sections, this invention too is based on a tennis racket having a tensioning frame which carries the array of taut strings and is designed as a hollow profile.

20 The solution to the problem posed, that is to say to improve the tennis racket construction whilst at the same time enabling it economically to be produced, consists in that the hollow section comprises at least two main profiles which are connected to one 25 another (or about one another) in the plane of the stringing, or in a plane parallel thereto.

The positioning of the connection plane of the two profiles in register with the stringing plane leads to the advantage that the junction between the two 30 hollow profiles lies in practice substantially in the region of the neutral region between tensile and compression stressing of the hollow section.

The connection of the two main profiles advantageously achieved in that projections or supports 35 extend beyond the connection plane, in each case, into the other profile. This achieves statically and dynamically improved characteristics for the hollow section.

An extremely simple version of the each profile is 40 achieved by making it symmetrical or rotationally symmetrical relative to the longitudinal axis of the tennis racket, i.e. the profiles are in practice identically the same and may even be produced from one and the same tool. Such an arrangement achieves a 45 considerable saving on tool costs.

Another embodiment takes more into account the simplicity of assembly of the two main profiles, in that string guides or recesses are provided only in one of the profiles, appropriate corresponding sup- 50 ports for the strings being provided in the other of the profiles.

A further strength property improvement is obtained by dividing the hollow interior cavity in a honeycomb manner by reinforcing webs. It is also 55 conceivable to design these reinforcing webs to serve as string guides.

In this respect, it is advantageous to arrange the reinforcing webs at least partially in the direction of the taut strings, in order to avoid transverse stres- 60 sing of the strings.

Not only for ease of assembly, but also for strength reasons, it is advantageous to arrange, in the two main profiles, corresponding fitting pins and fitting holes, which are able to absorb shearing 65 forces.

The arrangement of the string guides in one of the main profiles makes it possible to apply the stringing prior to the assembly together of the main profiles. In the current state of the art, each of the strings has 70 to be threaded through string openings, which, with about seventy openings means considerable expenditure of effort and labour. The introduction of the stringing prior to assembly of the main profiles in the racket of the invention is susceptible to 75 automation.

In production-technology respects it is possible, in the tennis racket of the invention, to provide for the string guides to terminate outwardly in grooves, so that the strings are protected by locating therein.

80 It is, however, possible to arrange the string guides inside the outer wall, so that they are covered or marked completely from the outside. This is undoubtedly a considerable advantage as compared with previous versions.

85 A further advantage consists in applying the stringing prior to assembly of the main profiles and to arrange, on at least one of the main profiles, clamping or tensioning wedges which, upon assembly, impart additional tension to the strings. Thus, 90 during application of the strings, they can be fitted with a lesser tension, which can be brought to the desired final value only after assembly.

The new construction behaves particularly favourably upon connection together of the main profiles. 95 The connection can, in accordance with a development of the invention, be effected for example by inserted and/or integrally-formed snap catches, these being popular toolless fittings.

However, the connection of the main profiles may 100 be achieved by forcing in of integrally-formed fitting pins into corresponding fitting holes in the main profiles. Absolutely new and progressive in the connection of the main profiles by means of rivets or screws which latter give the additional advantage of 105 providing a releasable connection.

Such the described kinds of connection not be adequate, the connection between the main profiles may, if desired, be improved by gluing or additional gluing. More especially where the tennis racket is 110 made of plastics material it is preferred to effect connection of the main profiles at least partially by welding.

It is advantageous to use reinforced plastics material, being reinforced, for example, with carbon 115 fibres. Since welding of plastics materials which are reinforced, for example, with carbon fibres is often difficult, it is furthermore proposed to insert, between the main profiles, a foil which is weldable with the reinforced plastics material and which has lesser 120 reinforcement or no reinforcement, which foil is then welded to both of the main profiles.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

125 *Figure 1* is a diagrammatic front view of the tensioning frame of a preferred embodiment of the tennis racket of the invention;

*Figure 2* is a side elevation corresponding to *Figure 1*, but showing the two profiles, which 130 together form the tensioning frame, spaced apart

from one another, for instance prior to being assembled together;

Figure 3 is a view comparable with Figure 2, but illustrating a second embodiment and showing the two profiles connected together;

Figure 4 is a fragmentary diagrammatic elevation illustrating part of one of the profiles in a development of the invention, and showing how the strings are applied;

Figure 5 is a side view corresponding to Figure 4;

Figure 6 is a fragmentary sectional detail showing one way in which the two profiles may be connected together in another development of the invention;

Figure 7 is a diagrammatic cross-section through the tensioning frame according to yet a further development of the invention;

Figure 8 is a view comparable with Figure 7 but showing another embodiment;

Figure 9 is a view comparable with Figures 7 and 8 but showing another development of the invention, in relation to connection together of the profiles forming the section of the tensioning frame; and

Figure 10 is a view similar to Figure 9 but showing yet another way of connecting the profiles together.

Figure 1 illustrates tensioning frame 1 of a preferred embodiment of the tennis racket of the invention, the longitudinal axis of which is indicated by the reference numeral 7. The frame 1 is generally of hollow cross-section, the basic or overall configuration of which has been indicated diagrammatically at 2. Figure 2 serves to indicate the position, in the tensioning frame 1, of connecting plane 5 at which profiles 3 and 4, which assemble together to form the tensioning frame 1, meet.

Designated by the reference numeral 6 are projections or supports which project from each profile 3, 4 and which extend beyond the connection plane into the other profile, in order to register and to secure the two parts to one another. Figure 3 illustrates an embodiment of the tennis racket in which string guides or recesses 8 are provided all in the profile 3, and in the profile 4 there are only complementary supports or retainers 9 which serve to ensure that the strings are located or retained in the guides 8.

Shown in Figures 4 and 5 is, for example, the configuration of reinforcing webs 10 which may optionally be provided in the main profiles 3, 4, these reinforcing webs 10 at the same time being designed to provide string guides or recesses 12, into which the strings 13 are inserted and retained. For strengthening the main profiles 3, 4, it is particularly important that the webs 10 should form honeycomb cavities 11, thereby achieving a frame which is exceptionally resistant statically. Figure 4 shows also the advantageous orientation of the webs 10 so that the string guides 8 extend in the directions of the strings 13.

Figure 6 shows, as an example, the engagement of fitting pins 14 into fitting holes 15, which are provided in the main profiles 3 and 4 respectively in order to ensure the mutual connection together of the profiles. Such fitting pins 14 and fitting holes 15 are advantageously provided at several locations of the main profiles.

It is of particular importance to provide protection

for the strings 13. Figure 7 shows an exemplified embodiment in which the string guides 12 culminate in sunken grooves 16 whereby the strings 13 are protected against mechanical damage.

Figure 8 shows another embodiment in which the string guides 12 each end inside the main profiles 3 and 4, so that the strings 13 can be threaded from one guide to the next inside the profiles. In this case outer wall 17 of the frame completely covers or masks the strings 13 which are thus protected against damage. This arrangement will preferably be provided where the connection together of the two main profiles 3 and 4 is such as to be releasable to permit separation thereof, for example by screws 20 as shown in Figure 6.

Figure 9 shows schematically another example of the numerous possibilities of connecting the two main profiles 3 and 4 together. In this case, the main profiles 3 and 4 need only to be pressed together, so that integrally-formed snaps springs or catches 19 secure the connection.

Another form of connection is exemplified by Figure 6 already referred to. It is possible, in this embodiment, for example, to design the fitting pins 14 and the fitting holes 15 in such a way that the fitting pins 14 are forced under substantial pressure into the fitting holes 15 and thus hold the main profiles 3 and 4 together without the need for providing the screws 20.

As previously described, a variant providing a releasable connection is known in Figure 6, the two main profiles 3 and 4 being held together by screws 20. Of course, both kinds of fastening, namely the fitting pins 14 and screws 20, can be combined.

In accordance with a development of the invention, adhesive may be employed in the connection together of the two profiles which form the frame, such adhesive being the sole medium which joins the two profiles 3, 4 or serving to supplement other connection arrangements such as have already been described.

It is also recommended, when the frame is made of plastics material, to weld the main profiles together. Since the main profiles are required to be of high strength a reinforced plastics material, in which the reinforcement is provided, for example by means of carbon fibres, is preferably used. Then, of course, the difficulties which arise in relation to the welding of such plastics materials have to be taken into consideration. Therefore, in accordance with another development of the invention it is recommended, in such a case, to weld the main profiles 3 and 4 with the interpolation of a foil 21 (see Figure 10) which is readily weldable to the reinforced plastics material and which incorporates less reinforcement or no reinforcement. In such a case, it is advisable to punch the foil so as to provide openings therethrough at the locations where, for example, string guides or fitting pins or other parts extending across the connection plane are disposed.

The various features of the described exemplified embodiments are, of course, susceptible to use in combination with one another, as desired, within the scope of the invention as defined by the following claims.

## CLAIMS

1. A tennis racket made of plastics material or  
5 light metal and comprising tensioning frame which  
serves as carrier for a set of taut strings and which is  
of a hollow section, characterised in that the hollow  
section comprises at least two main profiles which  
are connected to one another, or about one another,  
10 in the plane of the stringing or in a plane parallel  
thereto.
2. A tennis racket as claimed in claim 1, character-  
ised in that parts of each main profile extend  
beyond the connection plane, for example as projec-  
15 tions or supports which extend into other profile.
3. A tennis racket as claimed in claim 1 and 2,  
characterised in that the two main profiles are  
symmetrical or rotationally-symmetrically relative to  
the longitudinal axis of the tennis racket.
- 20 4. A tennis racket as claimed in claim 1 or 2,  
characterised in that string guides or recesses are  
provided only in one of the profiles corresponding  
supports for the strings being present in the other of  
the profiles.
- 25 5. A tennis racket as claimed in claim 1, 2 or 3,  
characterised in that reinforcing webs, which divide  
the hollow interior or cavity of the hollow section in  
honeycomb manner are present in the main profiles.
6. A tennis racket as claimed in claim 5, character-  
30 rised in that the reinforcement webs are designed as  
string guides.
7. A tennis racket as claimed in claim 6, character-  
ised in that the reinforcement webs extend at least  
partially in the direction of the taut strings.
- 35 8. A tennis racket as claimed in claim 1, 2 and 3,  
characterised in that corresponding fitting pins and  
fitting holes are present in the main profiles.
9. A tennis racket as claimed in claim 4, character-  
ised in that the stringing is applied prior to assem-  
40 bly together of the main profiles.
10. A tennis racket as claimed in claim 3 or 4,  
characterised in that the string guides culminate  
outwardly in grooves which receive and protect the  
strings.
- 45 11. A tennis racket as claimed in claim 4, char-  
acterised in that the string guides terminate inside  
the outer wall of the frame and the strings are  
covered on the outside.
12. A tennis racket as claimed in claim 9, char-  
50 acterised in that clamping or tensioning wedges  
which, upon the assembly together of the main  
profiles permit additional tensioning to the strings of  
the stringing, are provided at least on one of the  
profiles.
- 55 13. A tennis racket as claimed in claim 1, char-  
acterised in that the connection of the main profiles  
is effected by inserted and/or integrally-formed snap  
catches.
14. A tennis racket as claimed in claim 1, char-  
60 acterised in that connection together of the main  
profiles is effected by forcing integrally formed  
fitting pins in each profile into corresponding fitting  
holes in the other profile.
15. A tennis racket as claimed in claim 1, char-  
65 acterised in that the connection together of the main

profiles is effected by means of rivets or screws.

16. A tennis racket as claimed in claim 1 or 13 or  
14 or 15, characterised in that the connection  
together of the main profiles is effected by gluing or  
70 additional gluing.

17. A tennis racket as claimed in claim 1, char-  
acterised in that the connection together of the main  
profiles is effected at least partially by welding.

18. A tennis racket as claimed in claim 1, char-  
75 acterised in that it is of a plastics material which is  
reinforced, for example with carbon fibres.

19. A tennis racket as claimed in claim 18,  
characterised in that the main profiles are welded  
together with the interpolation therebetween of a foil  
80 which is weldable to the reinforced plastics material  
and which has lesser reinforcement or has no  
reinforcement.

20. A tennis racket as claimed in claim 19,  
characterised in that the interpolated foil is punched  
85 or stamped to provide gaps at specific locations, for  
example at the string guides or the fitting pins.

21. A tennis racket substantially as hereinbefore  
described with reference to and as illustrated in any  
of the Figures of the accompanying drawings.